

Appendix D

Transponder Test Procedures

The following steps were used to test the susceptibility of a VTS-like transponder system to a 12.5 kHz interferer tuned 12.5 kHz from the transponder channel carrier. The transponder system operates according to the procedures outlined in ITU-R M.825 with some enhancements. The system is able to update the status information of a participating vessel by interrogating the ship's transponder every 10 seconds. The ship's transponder responds to the interrogations by sending the ship's information (i.e., ship's ID, heading, speed, location, draft, cargo) back to the system controller. This information is then sent by the controller to the other vessels participating in the system. The transponder is considered to be in failure mode if it is not able to reply to the system controller's interrogations for information.

The objective of this test was to inject sufficient adjacent channel interference into the transponder receiver so that it could no longer receive the system controller's interrogations and be put in a failure mode.

The transponder was tested using the set-up shown below in Figure D-1.

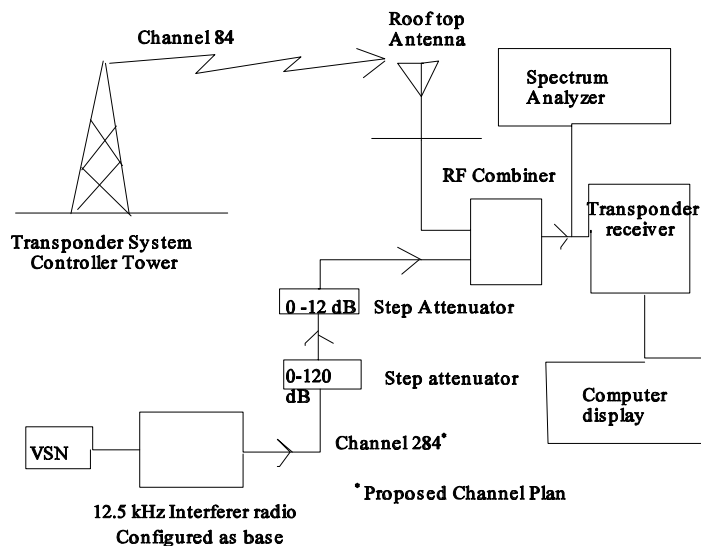


Figure D-1
VTS-Like Transponder Test Set-up

The following steps were taken to perform the transponder tests.

1. The transponder being tested was operating as a stationary unit in the laboratory of the test facility. The transponder was connected to a rooftop antenna and was communicating with the system controller at the test facility via a tower located 3 miles from the building.

2. Since the transponder had already been “acquired” by the system on channel 70, it was now communicating with the system controller on duplex channel 84 as a mobile unit. The 12.5 kHz interferer radio was tuned to channel 284 (the interstitial 12.5 kHz offset from the carrier of channel 84) and was modulated by VSN matched in amplitude to a 1 kHz tone that would produce a 1.5 kHz signal deviation. The interferer was configured as a base unit operating on the interstitial channel.
3. The RF output of the interferer radio was connected to a 3 dB attenuator and then to adjustable RF step attenuators. The output of the attenuators was then connected to one input of a 2-to-1 RF combiner. The other input to the combiner was connected to the cable of the rooftop antenna. The output of the combiner was then connected to the RF input of the transponder receiver.
4. The attenuators were set to their maximum value and the interferer radio was keyed up so that it would inject interference into the transponder.
5. The power of the adjacent channel interference was increased by decreasing the value of the step attenuators so that the interferer would disrupt the transponder operations. The power of the interferer was increased till the transponder could no longer respond to the system controller’s interrogations. When the transponder was in failure mode, the power of the interferer at the input to the transponder was measured in dBm with the spectrum analyzer and its value recorded.

Transponder Test Results

The transponder was able to respond to the controller’s polls and reach a 50% reply rate with an interference power of -26 dBm injected into its RF input on an adjacent interstitial channel. The transponder was unable to receive interrogations with an interference power of -25 dBm injected into its RF input and was considered to be in failure mode. These tests were performed while the transponder was in “distance mode”. By switching to “local mode” the transponder could withstand an additional 2-3 dB of interference power before failure occurred.

The desired transponder signal measured at the input to the transponder receiver was approximately -60 dBm. The Signal-to-Interference (S/I) ratio for the 50% reply rate for the transponder receiver was -34 dB and the S/I ratio for failure mode was -35 dB.